

REMARKS / DISCUSSION OF ISSUES

Claims 1-22 are pending in the present application.

35 U.S.C. §103 Rejections

A. The present Office Action rejects claims 1, 7, 12-13, and 21-22 under 35 U.S.C. §103(a) over U.S. Patent No. 6,477,054 to Hagerup (the *Hagerup* patent). Applicants respectfully traverse this rejection. As explained below, claims 1, 7, 12-13, and 21-22 are patentable over the cited reference.

Claim 1 is allowable because the *Hagerup* patent fails to disclose a device for thermal management of an LED including a trace layer overlying and adjacent to said substrate with no additional layer between said trace layer and said substrate; and a pad overlying and adjacent to said trace layer with no additional layer between said pad and said trace layer, said pad being operable to mount said LED.

The present Office Action asserts that the *Hagerup* patent discloses a substrate (14) overlying the heat sink; a trace layer (26) overlying and adjacent the substrate; and a pad (22) overlying and adjacent to the trace layer. The present Office Action fails to note first dielectric layer 12 interposed between pad (22) [*Hagerup*, second conductive element] and trace layer (26) [*Hagerup*, second conductive pattern], which prevents the pad (22) from being adjacent to the trace layer (26) without additional layers as claimed. See Figure 4; column 3, lines 22-45; column 4, lines 1-11.

Claim 12 is allowable because the *Hagerup* patent fails to disclose a device for thermal management of an LED including a flexible substrate in thermal communication with said trace layer and said heatsink.

The present Office Action asserts that the *Hagerup* patent discloses 'a flexible substrate' because the substrate is capable of being flexed as defined by *Merriam Webster's Dictionary*, and that the fact that the substrate is flexible but becomes rigid is not convincing because the substrate is materially a flexible tape and capable of being flexed. The Applicants respectfully disagree. *Merriam Webster's Dictionary* further defines flexible as pliant, which is a synonym of pliable, i.e., supple enough to bend

freely or repeatedly without breaking. *Merriam Webster's Dictionary* further defines flex as to bend especially repeatedly. Thus, flexible has the sense of pliability and suppleness. The present application clearly distinguishes printed circuit board (PCB) layers, which are generally inflexible, from the flexible substrate. See Specification page 3, lines 3-11; Specification page 4, lines 15-20; Claims 6, 7. This is further supported in the U.S. Patent No. 7,155,812 to Peterson, *et al.*, previously cited, which explains at column 1, lines 28-41, that LTCC materials are flexible and formable in the 'green' unfired state, and become rigid upon firing. Flexible describes a physical characteristic of the substrate. The *Hagerup* patent discloses a low temperature co-fired ceramic substrate structure formed of individual layers of dielectric LTCC material. See Abstract; column 3, lines 11-21. At most, the *Hagerup* patent discloses a rigid co-fired ceramic structure, not a flexible substrate as claimed.

Claims 7, 21, and 22; and claim 13 depend directly or indirectly from independent claims 1 and 12, respectively, and so include all the elements and limitations of their respective independent claims. Applicants therefore respectfully submit that dependent claims 7, 13, 21, and 22 are allowable over the *Hagerup* patent for at least the same reasons as set forth above for their respective independent claims.

Claims 21 and 22 are further allowable because neither the *Hagerup* patent does not disclose a device for thermal management of an LED including a via including a sidewall defining a channel through said substrate, a thermal conductive material filling at least a portion of said channel as recited in claim 21, or said thermal conductive material being solder as recited in claim 22.

Further regarding claims 21 and 22, although not stated in the section heading, the present Office Action relies on the *Nakamura* patent and asserts that the *Nakamura* patent discloses a thermal conductive material filling and/or solder at least a portion of the channel [sic] because first and second heat radiating patterns 3a/3b are soldered to the circuit board 2. Applicants respectfully assert that heat radiating plate 11 is soldered onto the first radiating pattern 3a and the first heat radiating pattern 3a can be formed simultaneously with the wiring pattern as a part thereof. See Figure 2; column 4, line 57

through column 5, line 6. The *Nakamura* patent fails to disclose solder or any other thermal conductive material interior to the copper foil 5a.

Applicants respectfully request withdrawal of the rejection of claims 1, 7, 12-13, and 21-22.

B. The present Office Action rejects claim 6 under 35 U.S.C. §103(a) over the *Hagerup* patent in light of U.S. Patent No. 5,604,673 to Washburn, *et al.* (the *Washburn* patent). Applicants respectfully traverse this rejection. As explained below, claim 6 is patentable over the cited references taken individually or in combination.

Claim 6 is allowable because the *Hagerup* patent fails to disclose a device for thermal management of an LED including a trace layer overlying and adjacent to said substrate with no additional layer between said trace layer and said substrate; and a pad overlying and adjacent to said trace layer with no additional layer between said pad and said trace layer, said pad being operable to mount said LED as recited in independent claim 1 and discussed in Section A above. The *Washburn* patent also fails to disclose these limitations. Claim 6 depends directly from independent claim 1 and so includes all the elements and limitations of independent claim 1. Claim 6 is allowable over the *Hagerup* patent and the *Washburn* patent for at least the same reasons as independent claim 1.

Applicants respectfully request withdrawal of the rejection of claim 6.

C. The present Office Action rejects claims 2-5 under 35 U.S.C. §103(a) over the *Hagerup* patent in light of U.S. Patent No. 6,226,183 to Weber, *et al.* (the *Weber* patent). Applicants respectfully traverse this rejection. As explained below, claims 2-5 are patentable over the cited references taken individually or in combination.

Claims 2-5 are allowable because the *Hagerup* patent fails to disclose a device for thermal management of an LED including a trace layer overlying and adjacent to said substrate with no additional layer between said trace layer and said substrate; and a pad overlying and adjacent to said trace layer with no additional layer between said pad and said trace layer, said pad being operable to mount said LED as recited in

independent claim 1 and discussed in Section A above. The *Weber* patent also fails to disclose these limitations. Claims 2-5 depend directly or indirectly from independent claim 1 and so include all the elements and limitations of independent claim 1. Claims 2-5 are allowable over the *Hagerup* patent and the *Weber* patent for at least the same reasons as independent claim 1.

Applicants respectfully request withdrawal of the rejection of claims 2-5.

D. The present Office Action rejects claims 8-11 and 14-17 under 35 U.S.C. §103(a) over the *Hagerup* patent in light of U.S. Patent No. 7,054,159 to Nakamura (the *Nakamura* patent). Applicants respectfully traverse this rejection. As explained below, claims 8-11 and 14-17 are patentable over the cited references taken individually or in combination.

Claims 8-11 are allowable because the *Hagerup* patent fails to disclose a device for thermal management of an LED including a trace layer overlying and adjacent to said substrate with no additional layer between said trace layer and said substrate; and a pad overlying and adjacent to said trace layer with no additional layer between said pad and said trace layer, said pad being operable to mount said LED as recited in independent claim 1 and discussed in Section A above. Claims 8-11 depend directly or indirectly from independent claim 1 and so include all the elements and limitations of independent claim 1. The *Nakamura* patent also fails to disclose these limitations. Claims 8-11 are allowable over the *Hagerup* patent and the *Nakamura* patent for at least the same reasons as independent claim 1.

Claims 14-17 are allowable because the *Hagerup* patent fails to disclose a device for thermal management of an LED including a flexible substrate in thermal communication with said trace layer and said heatsink as recited in independent claim 12 and discussed in Section A above. The *Nakamura* patent also fails to disclose these limitations. Claims 14-17 depend directly or indirectly from independent claim 12 and so include all the elements and limitations of independent claim 12. Claims 14-17 are allowable over the *Hagerup* patent and the *Nakamura* patent for at least the same reasons as independent claim 12.

Regarding claims 15 and 17, the present Office Action asserts that the *Nakamura* patent discloses a thermal conductive material filling at least a portion of the channel because first and second heat radiating patterns 3a/3b are soldered to the circuit board 2. Applicants respectfully assert that heat radiating plate 11 is soldered onto the first radiating pattern 3a and the first heat radiating pattern 3a can be formed simultaneously with the wiring pattern as a part thereof. See Figure 2; column 4, line 57 through column 5, line 6. The *Nakamura* patent fails to disclose solder or any other thermal conductive material interior to the copper foil 5a.

Applicants respectfully request withdrawal of the rejection of claims 8-11 and 14-17.

E. The present Office Action rejects claims 18-20 under 35 U.S.C. §103(a) over the *Weber* patent in light of the *Nakamura* patent. Applicants respectfully traverse this rejection. As explained below, claims 18-20 are patentable over the cited references. Applicants respectfully traverse this rejection. As explained below, claims 18-20 are patentable over the cited references taken individually or in combination.

Claim 18 is allowable because the *Weber* patent and the *Nakamura* patent fail to disclose a pad overlying and adjacent to said trace layer with no additional layer between said pad and said trace layer, said pad being operable to mount said LED, as recited in claim 18. The present Office Action asserts that the *Weber* patent discloses a device comprising: a heat sink (1); a substrate (2) overlying the heat sink; a trace layer (10) overlying the substrate; and a via (4). Applicants respectfully assert that the *Weber* patent fails to disclose a pad and the *Nakamura* patent also fails to do so.

Claims 19 and 20 depend directly from independent claim 18, and so include all the elements and limitations of independent claim 18. Applicants therefore respectfully submit that dependent claims 19 and 20 are allowable over the *Weber* patent and the *Nakamura* patent for at least the same reasons as set forth above for independent claim 18.

Regarding claim 19, the present Office Action asserts that the *Nakamura* patent discloses a thermal conductive material filling at least a portion of the channel because

first and second heat radiating patterns 3a/3b are soldered to the circuit board 2. Applicants respectfully assert that heat radiating plate 11 is soldered onto the first radiating pattern 3a and the first heat radiating pattern 3a can be formed simultaneously with the wiring pattern as a part thereof. See Figure 2; column 4, line 57 through column 5, line 6. The *Nakamura* patent fails to disclose solder or any other thermal conductive material interior to the copper foil 5a.

Applicants respectfully request withdrawal of the rejection of claims 18-20.

In view of the foregoing, Applicants respectfully request that the Examiner withdraw the rejections of record, allow all the pending claims, and find the application to be in condition for allowance. If any points remain in issue that may best be resolved through a personal or telephonic interview, the Examiner is respectfully requested to contact the managing attorney, Mark L. Beloborodov, Registration No. 50,773, at (781) 418-9363.

Respectfully submitted,

/ LESLIE B. WILSON /

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